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VITAL ROOT RETENTION IN DOGS

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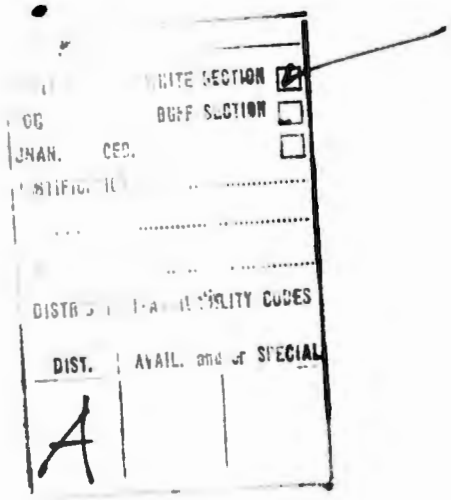

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13. ABSTRACT

Histologic and clinical studies have shown that retained tooth roots, when endodontically treated, prevent the resorption of alveolar bone. It has also been reported that root fragments recovered from jaws frequently show vital pulp tissue. However, it has not been determined if vital root retention is a feasible clinical procedure. The objective of this procedure would be to preserve alveolar bone for prosthetic appliances. The purpose of this study was to ascertain whether retained roots will maintain their vitality after removal of the clinical crowns. A buccal mucoperiosteal flap was raised bilaterally from the distofacial angle of the second bicuspid to the mesiofacial angle of the first molar in the mandible of three dogs. The crowns of the third and fourth bicuspids were removed using a high speed handpiece with water coolant, and the remaining root structure was smoothed to the level of the alveolar crest. A lingual flap was raised by blunt dissection, and horizontal split-thickness incisions were made along the base of both buccal and lingual flaps in order to obtain complete wound closure. The operative sites were irrigated with saline solution, and the flaps were sutured. At 60, 90, and 120 days, the animals were sacrificed, and block sections of the operated teeth and one adjacent bicuspid were surgically removed, sectioned, and stained. Histologic examination showed that (1) vitality of all root stumps was maintained up to 120 days; (2) calcifications developed at the orifices of the canals; (3) no detectable pathologic changes occurred.

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ABSTRACT

Histologic and clinical studies have shown that retained tooth roots, when endodontically treated, prevent the resorption of alveolar bone. It has also been reported that root fragments recovered from jaws frequently show vital pulp tissue. However, it has not been determined if vital root retention is a feasible clinical procedure. The objective of this procedure would be to preserve alveolar bone for prosthetic appliances. The purpose of this study was to ascertain whether retained roots will maintain their vitality after removal of the clinical crowns. A buccal mucoperiosteal flap was raised bilaterally from the distofacial angle of the second bicuspid to the mesiofacial angle of the first molar in the mandible of three dogs. The crowns of the third and fourth bicuspids were removed using a high speed handpiece with water coolant, and the remaining root structure was smoothed to the level of the alveolar crest. A lingual flap was raised by blunt dissection, and horizontal split-thickness incisions were made along the base of both buccal and lingual flaps in order to obtain complete wound closure. The operative sites were irrigated with saline solution, and the flaps were sutured. At 60, 90, and 120 days, the animals were sacrificed, and block sections of the operated teeth and one adjacent bicuspid were surgically removed, sectioned, and stained. Histologic examination showed that (1) vitality of all root stumps was maintained up to 120 days; (2) calcifications developed at the orifices of the canals; (3) no detectable pathologic changes occurred.

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INTRODUCTION

Roots without crowns, embedded or otherwise, have historically been the abomination of every dentist. Since most extracted teeth have undergone pathologic pulpal changes, the residual root fragments could be a source of future pathology. These root fragments, when observed on postoperative radiographs, are considered unesthetic by the operator and reflect bad form when seen by others. The stigma associated with such a professional procedure has unnecessarily delayed research on retaining vital root stumps.

Howell,[1] in 1960, began clinical trials in an attempt to preserve alveolar bone by retaining the roots of teeth. This was done by filling the root canals, sectioning the crowns from the roots, and closing a full thickness flap over the residual stump. Some of these cases have now been under observation for more than 10 years with no apparent loss of bone and with an adequate denture foundation being preserved.

Bjorn,[2] in 1961, conducted similar studies using dogs. He created periodontal lesions by removing the soft tissue and supporting bone on the facial one third of the roots. He then allowed the site to heal. After 6 months, he sectioned the crowns from the roots of these teeth, filled the root canals, placed an amalgam seal, and closed a full thickness flap over the root stump. Histologic followup showed complete or almost complete regeneration of the bone, periodontal membrane, and cementum in all animals.

In 1965 Bjorn[3] repeated this study, using human teeth that had severe periodontal involvement. Again, there was marked bone regeneration.

None of the aforementioned studies was concerned with the planned retention of vital root stumps. This study was conducted to determine whether retained vital root stumps without root-canal treatment will maintain their vitality after removal of the clinical crown. The ultimate objective of retaining them would be to preserve alveolar bone.

MATERIALS AND METHODS

Three adult dogs of mixed breeding were anesthetized with pentobarbital and preoperative radiographs of the operative sites were taken. The following procedure was performed bilaterally on the mandible. A buccal mucoperiosteal flap was raised from the distofacial angle of the second bicuspids to the mesiofacial angle of the first molar. Vertical incisions and blunt dissection were employed. The crowns of the third and fourth bicuspids were removed using a high speed handpiece with water coolant. The remaining root structure was smoothed to the level

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of the alveolar crest with dental burs and a bone file. The surgical sites were irrigated with sterile saline solution. A lingual flap was raised by blunt dissection, and horizontal split-thickness relaxing incisions were made along the base of both buccal and lingual flaps in order to obtain complete wound closure. The flaps were sutured with 00000 monofilament, using an atraumatic needle. Sterile techniques were followed throughout these procedures. Postoperative radiographs were taken, and the dogs were placed on a soft diet. The sutures were removed 5 days postoperatively.

At 60, 90, and 120 days the dogs were anesthetized and radiographs taken. One animal was sacrificed at the end of each time period by formalin perfusion via the common carotid arteries. Block sections of the operated teeth and one adjacent bicuspid were surgically removed for study. The block sections were fixed in a 10% formalin solution, decalcified in a 10% formic acid solution for 4 weeks, serially sectioned at 6 microns, and stained with hematoxylin and eosin.

RESULTS

The postoperative course of healing was uneventful. There was no clinical evidence of abnormal healing in any case, and the mucosa overlying the operated site appeared normal.

Comparison of the radiographs taken preoperatively with those taken during the course of healing and at the time of sacrifice did not reveal any significant changes in the roots or the surrounding bone. Histologic sections were obtained from four operated teeth (crowns removed) and two nonoperated teeth for each time period. Microscopic examination at 60, 90, and 120 days showed all roots to contain vital pulp tissue. The radicular portion of the pulp exhibited little, if any, change. The odontoblastic layer was intact; the cellular composition of the pulp was normal; and there were no significant inflammatory changes. The overlying connective tissue and epithelium were also normal.

Calcification was noted at the junction of the pulp canal and the overlying connective tissue of operated teeth. In some cases it was identifiable as secondary dentin and was continuous with the canal wall. These dentinoid calcifications had an irregular tubular structure, and appeared to represent an attempt to seal or bridge the orifice of the canal. In other sections, the calcifying tissue did not appear to be attached to the canal wall but was located centrally over the pulp canal. This tissue more closely resembled bone or osteoid histologically. A generous blood supply was evident between the overlying connective and pulp tissues in all sections.

DISCUSSION

The results of this study show that the dental pulp of dogs, when provided with an adequate blood supply, will heal in up to 120 days much like any connective tissue. This finding may provide a basis

for the development of a practical method of retaining vital roots in the mandible and maxillae of humans, thereby preserving the residual ridge to support dental prostheses. Admittedly, such a heretical technique may seem to have limited application. However, if it should prove to be practical in humans, it would be useful for treatment of carefully selected cases. The indication for this treatment might be a therapeutic requirement to remove teeth having vital pulps in areas where maintenance of the alveolar ridge was particularly critical. Further studies of this technique should be carried out in monkeys.

SUMMARY

A study utilizing three adult dogs was conducted to determine whether retained vital root stumps without root-canal treatment will maintain their vitality after removal of the clinical crown. Histologic examination showed that, up to 120 days:

1. Vitality of all root stumps was maintained.
2. Dentinoid calcifications formed in an apparent attempt to bridge the canal orifices.
3. No periapical pathology was present.

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